BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

OPIC
OFFICE DE LA PROPRIÉTÉ INTELLECTUELLE DU CANADA

CIPO
CANADIAN INTELLECTUAL PROPERTY OFFICE

Ottawa Hull K1A 0C9

(21) (A1) 2,119,391
(22) 1994/03/18
(43) 1994/12/16

(51) INTL.CL.[5] A23B-005/005; A23B-005/04

(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

5,080,8/50

(54) Methods and Apparatus for Pasteurizing Liquid Egg

(72) Papetti, Stephen T. - U.S.A. ;
Polny, Thaddeus J., Jr. - U.S.A. ;

(71) Same as inventor

(30) (US) 08/077,833 1993/06/15

(57) 31 Claims

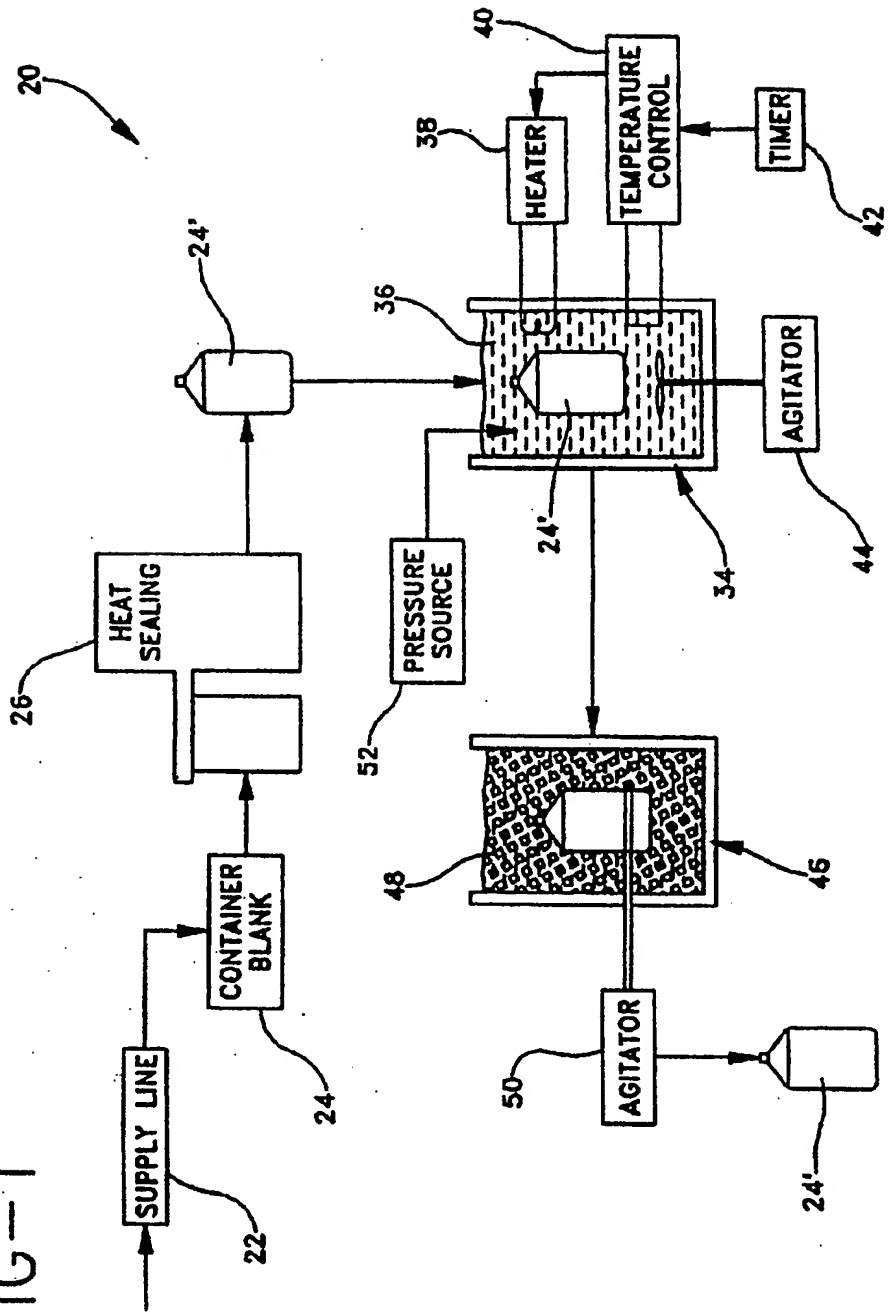


FIG-1

MOFFAT & CO.

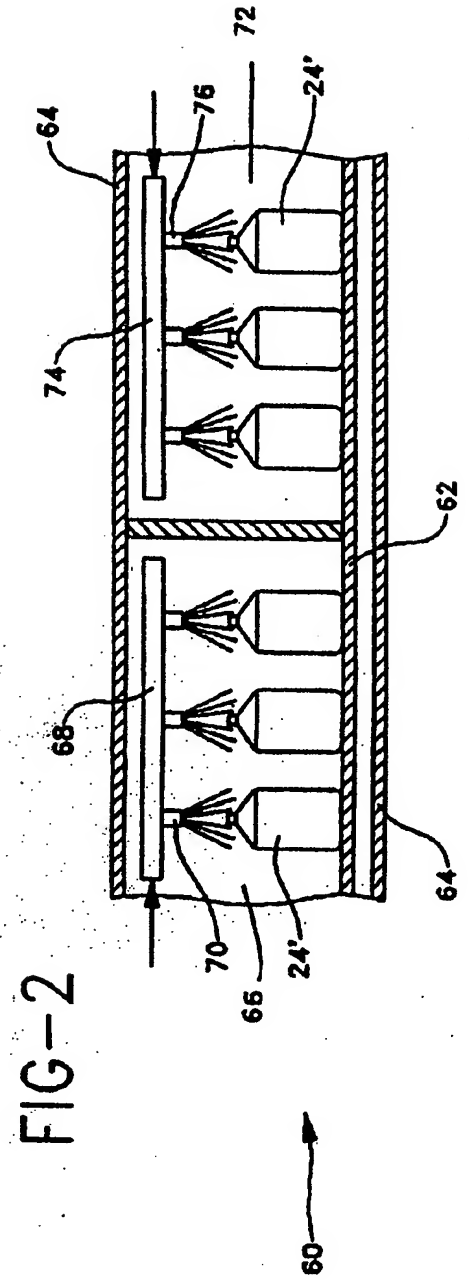


FIG-2

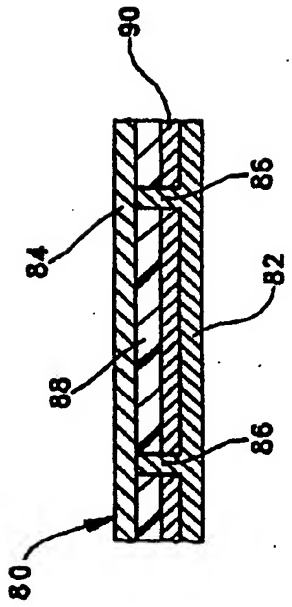


FIG-4

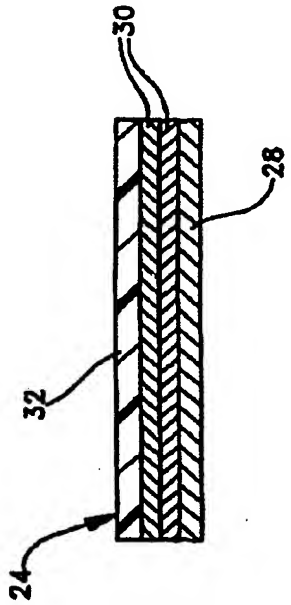


FIG-3

MOFFAT & CO.

FIG-5

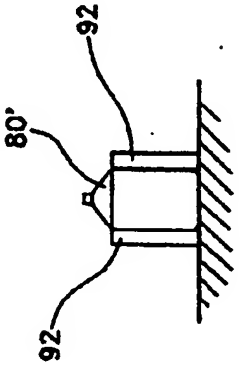


FIG-6

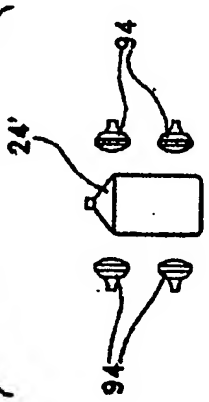


FIG-7

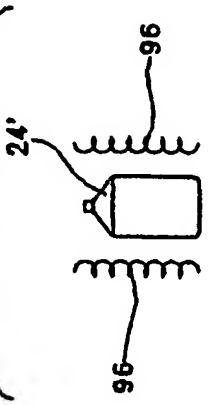


FIG-8

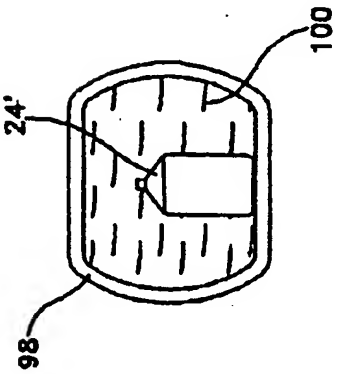


FIG-9

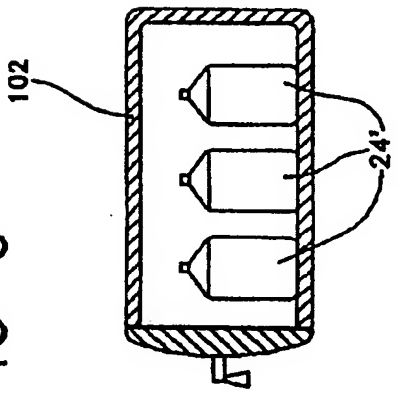
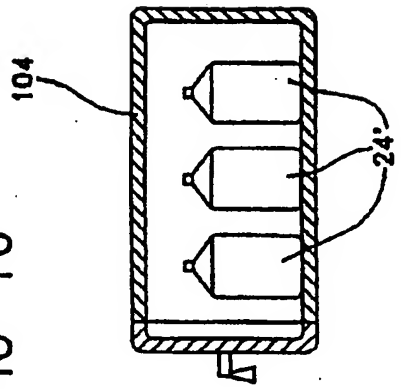


FIG-10



MOFFAT & CO.

ABSTRACT OF THE DISCLOSURE

The invention relates to the pasteurization of unpasteurized liquid egg or the re-pasteurization of previously pasteurized liquid egg not packaged in accordance with the requirements of aseptic packaging. The liquid egg is placed in a container and the contents are sealed into such container. The container is then moved to a heating means where the contents are heated to a temperature of 140°F to 155°F and maintained there for 30 minutes for unpasteurized liquid egg and for previously pasteurized liquid egg to a temperature of 155°F and maintained at such temperature for 3 to 4 minutes. The pasteurized liquid egg is then rapidly cooled to below 40°F.

Heating may be carried out in hot water baths, by use of hot water spray, hot gases, steam, radiant heating or ovens, and cooling may be effected by the use of vats of water and ice, cold water sprays, refrigeration or the like.

METHODS AND APPARATUS FOR PASTEURIZING LIQUID EGG

The instant invention relates to methods and apparatus for pasteurizing liquid egg which has been sealed in a container and which does not require aseptic packaging techniques and equipment.

There are a number of techniques known in the prior art for pasteurizing and processing liquid egg. The more popular approaches involve the use of conventional plate heat exchangers, steam infusion systems or combinations of both. Electroheating systems have recently been introduced which provide, among other things, a superior faster more uniform and complete pasteurization.

There are also a number of packaging techniques known in the prior art which have been used in connection with pasteurization techniques for providing an extended refrigerated shelf life for the packaged pasteurized liquid egg. Generally, these techniques have involved use of aseptic packaging techniques and equipment to package the pasteurized liquid egg and prevent the introduction of micro-organisms to the pasteurized liquid egg. These techniques require that all holding tanks, tubing, packaging materials, filling and sealing machines be aseptic and that no opportunity exists for the introduction of micro-organisms. The techniques for attaining and maintaining the aseptic characteristics is expensive and time consuming.

The concept of pasteurization of food products in sealed containers has been used in other areas of the food processing industry. These include, for example, dog food in U.S. Patent No. 3,738,847, issued June 12, 1973 to *Bechtel*; a sediment-free, chocolate-flavored beverage in U.S. Patent No. 3,615,659, issued October 26, 1971; cheese in U. S. Patent 4,627,984, issued December 9, 1986; an egg product resembling a hard boiled egg half in U.S. Patent No. 3,843,825, issued October 22, 1972; beer in U.S. Patent

No. 4,490,401, issued December 25, 1984; and fruit and vegetable juices in U.S. Patent No. 4,946,041, issued August 7, 1990.

In each of the above described patents, the food product which has been treated has been other than whole liquid egg. None of these prior patents recognize the unique characteristics and unique problems of whole liquid egg which make the described processes inappropriate for pasteurizing whole liquid egg. Liquid egg is unique, and when considering its preparation, processing and/or storage, a number of often competing criteria must be considered, including, without limitation: storage stability, content of potentially pathogenic bacteria, foaming ability, emulsion properties, viscosity, detrimental coagulation, and pourability. Those persons familiar with the qualities of liquid egg and the myriad problems that are caused when liquid egg is improperly processed on apparatus other than conventional plate heat exchangers and known packaging equipment, would not be expected to go to other available non-egg pasteurization processes or devices to pasteurize liquid egg.

The techniques normally applied to whole liquid egg are batch pasteurization or continuous pasteurization, followed by packaging which may include aseptic packaging. When aseptic packaging is employed, great care must be observed to insure that no micro-organisms are introduced into the pasteurized whole liquid egg after pasteurization and prior to the sealing of the container holding the whole liquid egg.

One known prior art pasteurization technique applied to whole liquid egg is that shown in U. S. Patent No. 5,048,404, issued September 17, 1991, which employs pulsed high voltage systems to pasteurize the liquid egg product. The liquid foodstuff is heated to about 122°F to 158°F and the cooled to 41°F to 50°F and packaged.

Similarly, in copending U.S. Patent Application No. 08/007,553, filed January 22, 1993 entitled "Methods and Apparatus for Electroheating Food Employing Concentric Electrodes" by Thaddeus Polny and assigned to the assignee of the instant invention, there is described an apparatus for the pasteurization of liquid egg by electroheating. Again, after the pasteurization is completed, the liquid egg is cooled and packaged.

Techniques for the post pasteurization of citrus and other juices and drinks after same have been placed in cartons without observing the usual aseptic techniques and packaging materials, in which the cartons are sealed and then subjected to post pasteurization techniques, are described in an article entitled "Gable Top Challenges The Brick" in the January 1992 issue of PACKAGING DIGEST. A first technique used by FBI Brands describes the use of a hot-water pasteurizer which raises the temperature of the materials in the sealed containers to 167°F, holds them at such temperatures for 7 to 10 minutes and then cools them, but does not describe how this cooling takes place. Such a technique applied to liquid egg would cause the egg to be at least partially cooked, and would cause caking and undesirable coagulation. There is no mention made of agitating the filled cartons or hot water bath to assure uniform heating of the contents, nor any mention made of instantly submerging the pasteurized cartons in an ice bath to terminate any further effects of the heating step.

The same article also mentions the use of a pasteurizing tunnel into which 20 filled cartons are moved at one time. The pasteurization tunnel is stated to include preheat, heat and cooling. Again, FBI states "Our pasteurization goal is 167°F which we hold for 5 to 10 minutes." Such pasteurization temperatures and the time of holding at such temperatures would render liquid egg unusable. The article fails to mention how

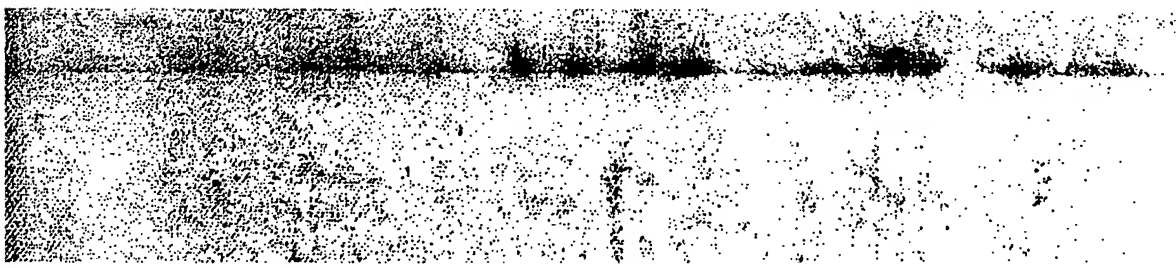
heating is carried out in the tunnel or where and how cooling takes place. No mention is made of rapid cooling after the pasteurization is complete to prevent overheating of the contents of the cartons. This technique would also result in an unusable liquid egg.

In accordance with the present invention, there is now provided a method of pasteurizing liquid egg sealed in its container or re-pasteurizing pasteurized liquid egg packaged in a container which was not aseptically handled. The liquid egg contained in a sealed container is pasteurized by heating the container to a selected pasteurizing temperature and holding same for a period of time sufficient to achieve pasteurization. The pasteurized liquid egg is then cooled after which it can be stored in a conventional manner. Liquid egg which has previously been pasteurized but which is not aseptically packaged can be re-pasteurized in its sealed container to eliminate any micro-organisms which could be introduced because of non-aseptic packaging.

It is also an object of the present invention to provide a technique for pasteurizing liquid egg sealed in a container.

In accordance with this aspect of the present invention, there is provided a hot fluid bath into which the sealed container of unpasteurized liquid egg (or the sealed container of pasteurized egg not aseptically packaged) may be totally immersed for a prescribed length of time in such hot fluid raised to an appropriate pasteurized temperature, with the bath or container, or both, agitated to provide for uniform heat transfer. Thereafter, the sealed container is removed from the hot fluid bath and plunged into an ice bath to quickly reduce the temperature of the liquid egg in the container. The liquid egg can now be stored in a conventional manner.

Additional equipment and techniques for post-packaging pasteurization of liquid egg in sealed



containers according to the concepts of the invention are also disclosed and described herein. These include the use of a tunnel with hot water spray in one portion to conduct the pasteurization, and cold water spray in a further portion to quickly cool the packaged liquid egg. A specially constructed container with foil layers therein can be heated by contact with external electrodes, or contents of a sealed container can be heated by infra-red lamp, radiant heaters, or in a tunnel subjected to steam or hot gases, or by being placed in an autoclave. After the packaged liquid egg is raised to the pasteurization temperature and held there for the prescribed time, the packaged liquid egg is quickly cooled by an ice bath, water spray or the like.

Other objects and features of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principles of the invention, and the best mode which has been presently contemplated for carrying them out.

In the drawings in which similar elements are given similar reference characters:

FIG. 1 is a schematic representation of one configuration of a sealed container pasteurizing system according to the concepts of the instant invention.

FIG. 2 is a schematic representation of another configuration of a sealed container pasteurizing system in accordance with the concepts of the invention.

FIG. 3 is a fragmentary side elevation, in sections, of a first form of container used with the pasteurizing system according to the concepts of the invention.

FIG. 4 is a fragmentary side elevation, in sections, of a further form of container used with the pasteurizing system according to the concepts of the invention.

FIG. 5 is a schematic representation of still another form of heating device for pasteurizing the contents of a sealed container according to the concepts of the invention.

FIG. 6 is yet another form of heating device for pasteurizing the contents of a sealed container.

FIGS. 7 to 10 are further forms of heating devices for pasteurizing the contents of a sealed container according to the concepts of the invention.

The term liquid egg in accordance with the present invention is meant to include not only liquid egg white and liquid egg yolk, but also combinations of each in any predetermined or desirable ratio. The term liquid egg also includes liquid egg white, liquid egg yolk, or combinations thereof (referred to as "liquid whole egg") with additives such as salt, sugar, milk, stabilizers, dextrins, cyclodextrins, peroxides, acids and food stuffs including solid or particulate foodstuffs. Liquid egg from which cholesterol has been removed is also included.

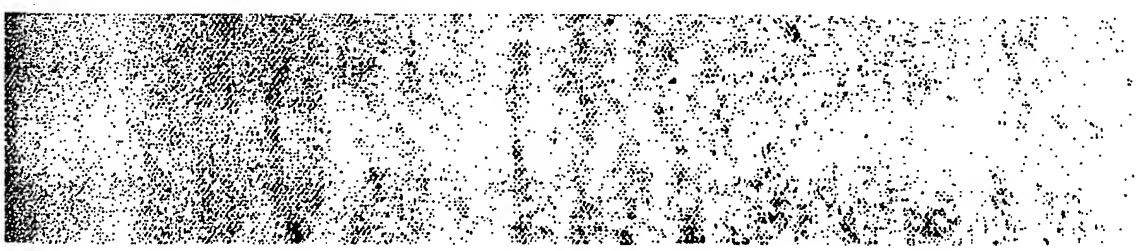
As used herein, the terms "pasteurization", "pasteurize" and "pasteurized" refer to the killing of sufficient pathogenic micro-organisms contained within food and in particular liquid egg so as to render the liquid egg edible without threat of, for example, *Salmonella* infection. "Pasteurization" may also be thought of as a treatment which is designed to eliminate, for all practical purposes, pathogenic micro-organisms and, in particular, *Salmonella*, and secondarily, to reduce the number of spoilage micro-organisms present to improve the keeping quality of the food product. At U.S.D.A. minimum time and temperature parameters, pasteurization will generally produce liquid whole egg which will have a refrigerated shelf life of between about 7 and 14 days. For liquid whole egg, a minimum temperature of 140°F and minimum holding time of 3.5 minutes is required. The definition of pasteurization, in terms of attained temperature and

holding times, for other foods is generally provided by government regulations and/or industry standards. They are therefore readily available.

"Extended refrigerated shelf life" means that the liquid egg is safe to consume for a period of at least 3 weeks after treatment in accordance with the present invention. This, of course, assumes proper refrigerated storage. Preferably, the term "extended refrigerated shelf life" means that the liquid egg is safe to consume for a period of at least 4 weeks after treatment in accordance with the present invention and more often 10 to 12 weeks after treatment, or longer. An extended refrigerated shelf life can also be imparted to other perishable foods by the practice of the present invention.

The term "retained baking functionality" means that despite the application of heat in accordance with the present invention, the liquid egg is useful for most commercial and home, if not all, baking applications. Baking functionality relates primarily to the emulsification properties of the liquid egg. This function directly relates to the stability of water/oil, water/air, oil/air, or water/oil/air phases. Emulsifications influences the viscosity of the batter, volume of the baked goods and stability thereof. The stability of a two or three phase system also greatly affects the texture of the resulting baked product. In a cake, a desirable soft uniform crumb can be achieved only with the proper emulsification system. In fact, the quality of certain baked goods, such as, for example, sponge cake, is considered wholly dependent upon the quality of the egg used. Good egg product, that is one having high baking functionality, yields high volume and soft texture.

The term "egg functionality" means all of the characteristics which affect liquid egg preparation, processing and/or storage and includes, but is not limited to, storage stability, content of potentially

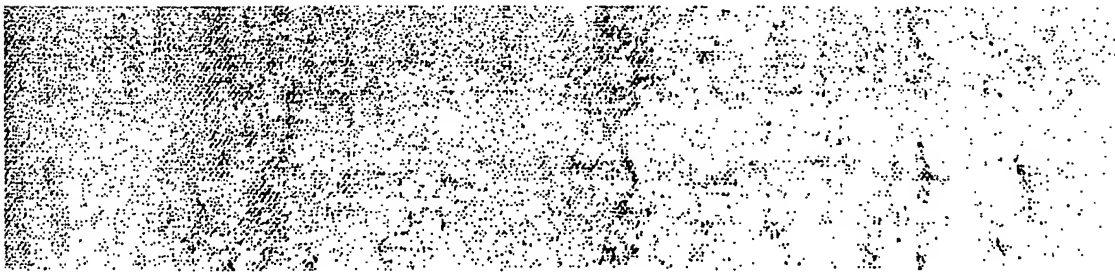


pathogenic bacteria, foaming ability, emulsion properties, viscosity, detrimental coagulation, pourability and retained baking functionality..

The term pasteurization is to be distinguished from sterilization wherein all of the pathogenic micro-organisms and the spoilage micro-organisms are destroyed. When liquid egg is sterilized, the resulting liquid eggs have no taste and only limited use such as for scrambling. The liquid eggs produced as a result of sealed carton pasteurization retain all of their desirable properties and characteristics.

Turning now to FIG. 1, there is shown a schematic representation of a sealed container liquid egg pasteurizing system 20 according to the instant invention. Liquid egg is conducted through supply line 22 to a container 24 to be filled. Supply line 22 may provide unpasteurized liquid egg or it may provide pasteurized liquid egg from a batch or continuous liquid egg pasteurizing system, one form of which is described and claimed in the above identified application Serial No. 07/862,198 filed April 2, 1992. The liquid egg is placed in an erected container blank 24 at a filing station. The container blank 24 is the type widely used in the food industry and may be of the type available from International Paper Company and others, and when completed forms the so-called gable-top container. When erected container blank 24 is filled as determined by column measurement, photoelectric cells or total container weight, the container 24 with liquid egg therein is advanced to a heat sealing station 26 wherein the open end of container blank 24 is sealed.

The container blank 24 as is shown in FIG. 3 is of a multi-layer construction and may include an inner foil layer 28 to protect the flavor of the contents, one or more cardboard or fiber layers 30 and an outer polyethylene layer 32 which can be suitably printed with labels, directions, etc.



The filled and sealed container 24' is next placed in a vat 34 and filled with a fluid such as water 36. A heater 38 will heat the water 36 to the desired temperature range for pasteurization. The technique shown is a batch process and as many containers 24' as desired can be placed in the selected vat size. The temperature selected can be in the range of 140°F to about 155°F. Temperature controller 40 will sense the temperature of the water 36 in vat 34 and turn the heater 38 on or off until the desired temperature is reached, and maintain the temperature of the water 36 uniformly for the pasteurization period as set by the timer 42. The amount of heat added by heater 38 will depend upon the number of filled containers 24' placed in the vat, the make-up of the containers and their contents. The pasteurization period for unpasteurized liquid eggs at 140°F is approximately 30 minutes and the pasteurization period for previously pasteurized liquid eggs is about three to four minutes at 155°F.

The water 36 in the vat 34 is agitated by agitator 44 to maintain a uniform temperature in vat 34 so that heat is uniformly transferred to the liquid egg in container 24'. Alternatively, the container 24' can be gently agitated by an agitator similar to agitator 50 in the cooling vat 46. Such agitation helps the contents of the container 24' to move around and assure a more even temperature distribution within container 24'. Also, the contents of vat 34 may be pressurized from a source of pressure 52 to prevent the deformation of the containers 24' due to the heating of its contents.

Cooling vat 46 is filled with an ice and water combination 48 to provide a rapid cool down of the heated contents of container 24' from the pasteurizing temperatures of 140°F to 155°F to below 40°F. Also cooling could be provided by chilled or refrigerated water, expanding liquified gases, etc.

Once the contents of container 24' have been properly cooled, the liquid egg may be stored and used in any conventional manner.

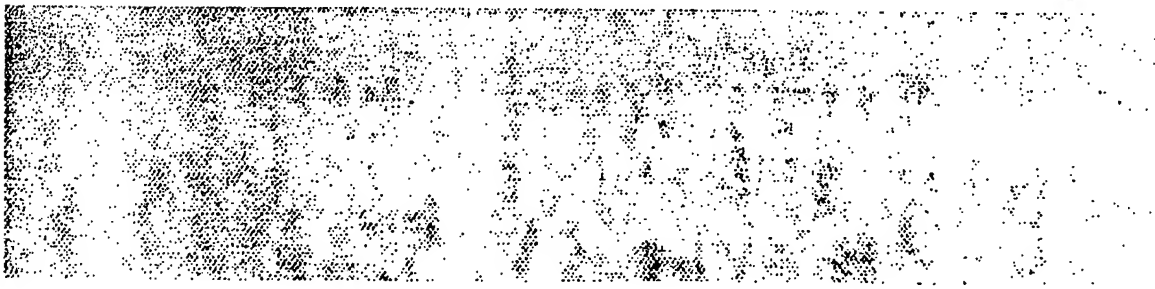
It has been found from testing the results of the above procedures that with raw, unpasteurized eggs having psychotrophs of 2000 and a total plate count of 1600, the psychotrophs were reduced to 100 and the total plate count was reduced to below 100. In previously pasteurized liquid eggs having psychrotrophs of 700 and a total plate count of 100, the psychotrophs were reduced to 100 and the total plate count reduced below 100. These values correspond favorably with similar readings taken of pasteurized liquid eggs placed in aseptic packaging.

Turning now to FIG. 2, there is shown a further technique and apparatus 60 for pasteurizing and cooling liquid egg in a sealed, filled container 24'. The containers 24' are advanced on a conveyor belt 62 through a tunnel 64. A fluid such as hot water, from a source (not shown) is fed to a manifold 68 which contains a series of spray heads 70 which apply controlled streams of hot water or other fluid to the containers 24'. The containers 24' can be retained in a heating portion 66 of the tunnel 64 or the heating portion 66 may be made long enough that the moving containers 24' are heated to and maintained at the pasteurizing temperature for the desired period. After pasteurization, containers 24' are moved to cooling portion 72 and subjected to a cold water spray from the spray heads 76 connected to cold water manifold 74 supplied from a source of cold water (not shown). Of course, another type of cooling fluid could be employed instead of cold water. The containers 24' will remain in the cooling portion 72 of tunnel 64 for sufficient time to reduce the temperature of the contents of containers 24' below 40°F. This may be done by stopping the conveyor belt 62 in tunnel 64 or having the cooling portion long enough for the cool down to take place. A

sample container with heat and cooling sensors inserted therein may be used to provide to an operator or automatic controls accurate readings of the temperatures within container 24'.

Turning to FIGS. 4 and 5, a further form of container is shown along with the apparatus employed to heat the container 24' contents. Referring to FIG. 4 a unique container 80 construction is shown. A foil layer 82 on the inside of the container 80 is similar to foil layer 28 of FIG. 3. It serves to prevent contact of the container 80 contents with the container materials to prevent any reaction that might effect the liquid egg contained within. A foil layer 84 is positioned on the outer surface of container 80 and is connected by lands 86 to foil layer 82. The lands 86 permit current applied to foil layer 84 to be conducted to foil layer 82. An insulating layer of polyethylene 88 and a layer of cardboard or fiber 90 is placed between the foil layers 82 and 84. The filled and sealed container 80' is positioned between two electrodes 92. The electrodes 92 are in direct contact with foil layer 84. Current is passed from a source (not shown) to an electrode 92, and by lands 86 to foil layer 82 and then through the liquid egg in contact with foil layer 82 on all sides and then to the second electrode 92. Heating takes place in the container by means of electroheating. Once the temperature has risen to the pasteurizing temperature and has been maintained there for the prescribed period, the containers 80' are quickly immersed in an ice and water bath to chill the contents of containers 80' below 40°F. After which the pasteurized liquid egg may be used in a conventional manner.

FIG. 6 shows how the contents of a filled, sealed container 24' may be heated by a set of infra-red lamps 94. A radiant heater as shown by coils 96 in FIG. 7 can be used to heat the contents of container 24'. FIG. 8 shows how container 24' may be



placed in a tunnel 98 and subjected to steam or other hot gases 100 to carry out the pasteurization of the contents of container 24'.

FIG. 9 shows how containers 24' can be heated in an autoclave 102 under controlled temperature and pressure. FIG. 10 shows a conventional oven 104 which may be gas fired or electric or otherwise which may be used to heat the contents of containers 24'. The heated contents of containers 24' may then be cooled, regardless of which technique is used to heat the container 24' contents by immersion in an ice-water bath, by a spray of cold water, by refrigeration or the like.

While there have been shown and described and pointed out the fundamental novel features of the invention applied to the preferred embodiments, it will be understood that various omissions and substitutions and changes in the details of the devices illustrated and in their operation may be made by those skilled in the art, without departing from the spirit of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for pasteurizing the contents of a sealed container containing liquid egg, which container has not been aseptically maintained nor aseptically filled, comprising the steps of heating the contents of the sealed container to a temperature sufficient to initiate pasteurization of the contents; maintaining the temperature of the contents of the sealed container at the pasteurizing temperature for a period of time sufficient to complete the pasteurization of the contents of said sealed container without substantially affecting the egg functionality of said liquid egg and thereafter cooling the contents of said sealed container to maintain said liquid egg in liquid form.

2. The method of Claim 1, wherein said cooling is carried out quickly to terminate the pasteurization process and render the contents of said sealed container ready for use.

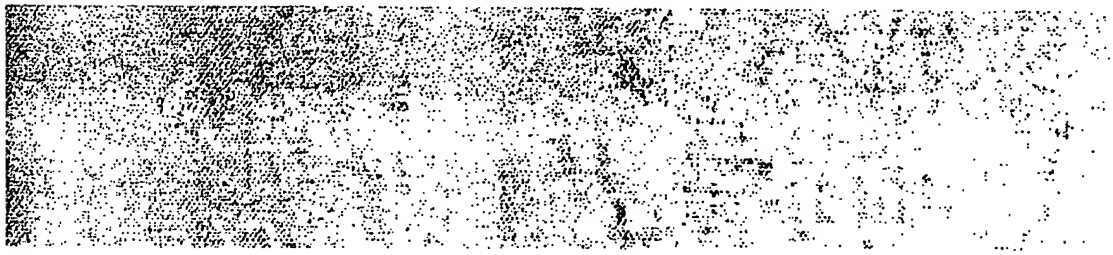
3. The method of Claim 1 or 2, wherein said heating step is carried out by immersion of said sealed container into a vat of hot water.

4. The method of Claim 1 or 2, wherein said heating step is carried out by subjecting said sealed container to a hot water spray.

5. The method of Claim 1 or 2, wherein the heating step is carried out by subjecting the contents of the sealed container to current sufficient to heat the contents by electroheating.

6. The method of Claim 5, wherein the current supplied to said sealed container is provided by contacting a foil on the outside of said sealed container which is connected to a foil on the inside of said sealed container by a series of conductive lands.

7. The method of Claim 1 or 2, wherein said heating step is carried out by subjecting the contents of the sealed container to a radiant heater.



8. The method of Claim 1 or 2, wherein the heating step is carried out within a chamber into which steam is introduced to heat the contents of the sealed container.

9. The method of Claim 1 or 2, wherein the heating step is carried out within a chamber into which hot gases are introduced to heat the contents of the sealed container.

10. The method of Claim 1 or 2, wherein the heating step is carried out in an autoclave to heat the contents of said sealed container.

11. The method of Claim 1 or 2, wherein the heating step is carried out in a furnace to heat the contents of said sealed container.

12. The method of Claim 1, wherein the contents of the sealed container are raised to a temperature in the range of 140°F to 155°F.

13. The method of Claim 1, 2 or 3, wherein said contents of the sealed container already pasteurized are heated to 155°F and retained at such temperature for a period of three to four minutes to eliminate any micro-organisms introduced by the manner in which said container is filled and sealed.

14. The method of Claim 1, 2 or 3, wherein said cooling step is carried out by immersing said sealed container in a bath of ice and water.

15. The method of Claim 1, wherein said cooling step is carried out by subjecting said sealed container to a spray of cold water.

16. Apparatus for pasteurizing the contents of a sealed container containing liquid egg comprising heating means for heating the contents of a sealed container to a pasteurizing temperature; timer means to control the length of time said heating means is operated for a prescribed period of time; and cooling means for cooling the contents of said containers.

17. The apparatus of Claim 16, wherein said liquid egg is unpasteurized and said liquid egg is

heated to a pasteurizing temperature in the range of 140°F to 155°F and maintained at said temperature for a period of thirty minutes and thereafter said liquid egg is cooled rapidly below 40°F.

18. The apparatus of Claim 16, wherein said liquid egg is pasteurized and said liquid egg is heated to a pasteurizing temperature of 155°F and maintained at said temperature for a period of 3 to 4 minutes to eliminate any micro-organisms by the manner in which said container is filled and sealed.

19. An apparatus of Claim 16, wherein said heating means is a vat of hot water into which said sealed container is immersed.

20. An apparatus of Claim 16, wherein said heating means is a hot water spray sprayed upon said sealed containers.

21. An apparatus of Claim 16, wherein said heating means is a pair of electrodes impressed upon said container and through which current is passed to electroheat the contents of said sealed container.

22. An apparatus of Claim 21, wherein said electrodes contact a foil layer on the outside of said container which is connected to a foil layer on the inside of said container by a series of conductive lands which extend between said inside and outside foil layers.

23. The apparatus of Claim 16, wherein said heating means comprise radiant heater means.

24. The apparatus of Claim 16, wherein said heating means is a chamber into which said sealed container is placed and steam is introduced into said chamber to effect heating.

25. The apparatus of Claim 16, wherein said heating means is a chamber into which said sealed container is placed and hot gases are introduced into said chamber to effect heating.

26. The apparatus of Claim 16, wherein said heating means is an autoclave.

27. The apparatus of Claim 16, wherein said heating means is an oven.

28. The apparatus of Claim 19, further comprising agitation means in said vat for gently agitating said hot water to provide uniform heating of the contents of said sealed container.

29. The apparatus of Claim 19, further comprising pressure means to apply an external pressure on said container to prevent its distortion during pasteurization.

30. The apparatus of Claim 16, wherein said cooling means is a vat of ice and water into which said sealed container is placed.

31. The apparatus of Claim 30, further comprising agitation means positioned in said cooling means to gently agitate said container to insure uniform cooling of the contents.